Effects of Cold on Military Equipment

Reference NWTC Cold Weather Operations Manual; FM 9-207, Mar 98

Outline

Cold Conditions

Effects of Cold On Materials

Antifreeze, Fuels, Lubricants and Batteries

Effects of Cold on Military Vehicles

Effects of Cold on Weapons Systems

Effects of Cold on Communications Equipment

Cold Conditions

COLD- few problems down to 10°F; for temperatures 10° to -25°F special considerations for operations such as winterization of vehicles; below -25°F routine tasks become complex

CONDENSATION- occurs when cold equipment is quickly exposed to a warmer environment

SNOW- introduces moisture to equipment and causes mobility problems; increases equipment loss

FROZEN SURFACES- hinders emplacement of stakes, grounding rods; creates unstable firing platforms; possible contact frostbite

Effects on Materials

METALS- brittle in severe cold; at -20°F certain metals (especially steel) can't withstand a shock load

RUBBER- remains flexible until below -20°F

RUBBER COVERED CABLES- easily cracked at low temp; should be re-warmed before bending

PLASTICS- generally expand and contract more than metals

GLASS- windshields may crack if heat is applied too rapidly

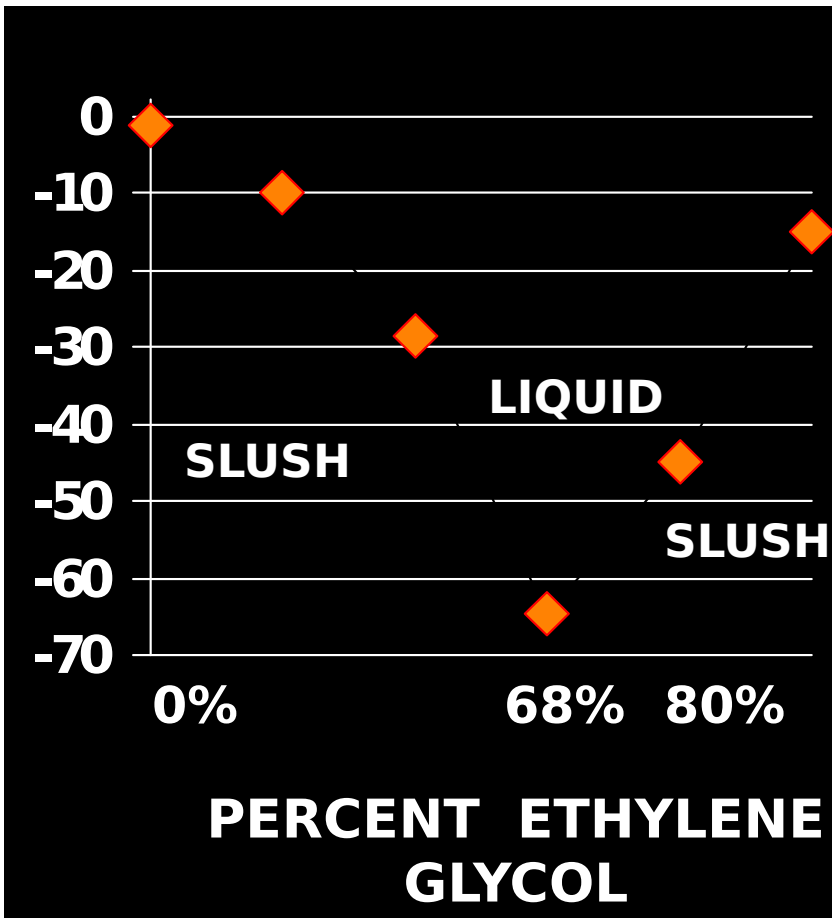
FABRICS- retain flexibility if kept dry; shrinkage can occur

Antifreeze

Ethylene-Glycol must be mixed to a proportion of water to be effective; 68% antifreeze and 32% water is optimum.

Use of a block heater is important as ice crystals will begin to form at -40°F

Arctic type antifreeze protects to -90°F



Fuels

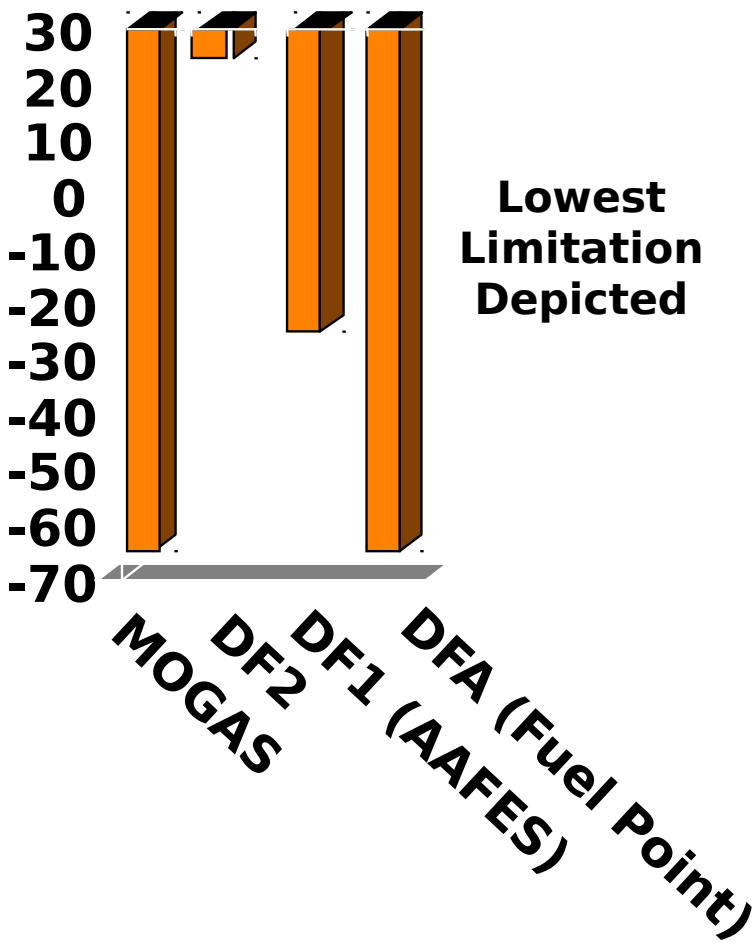
MOGAS is not affected significantly by low temp

Diesel fuel is greatly changed by the formation of waxes

Condensation can contaminate fuel and turn into ice crystals

Additives can inhibit icing

The fuel point has DFA; and AAFES sells DF1 during the winter months



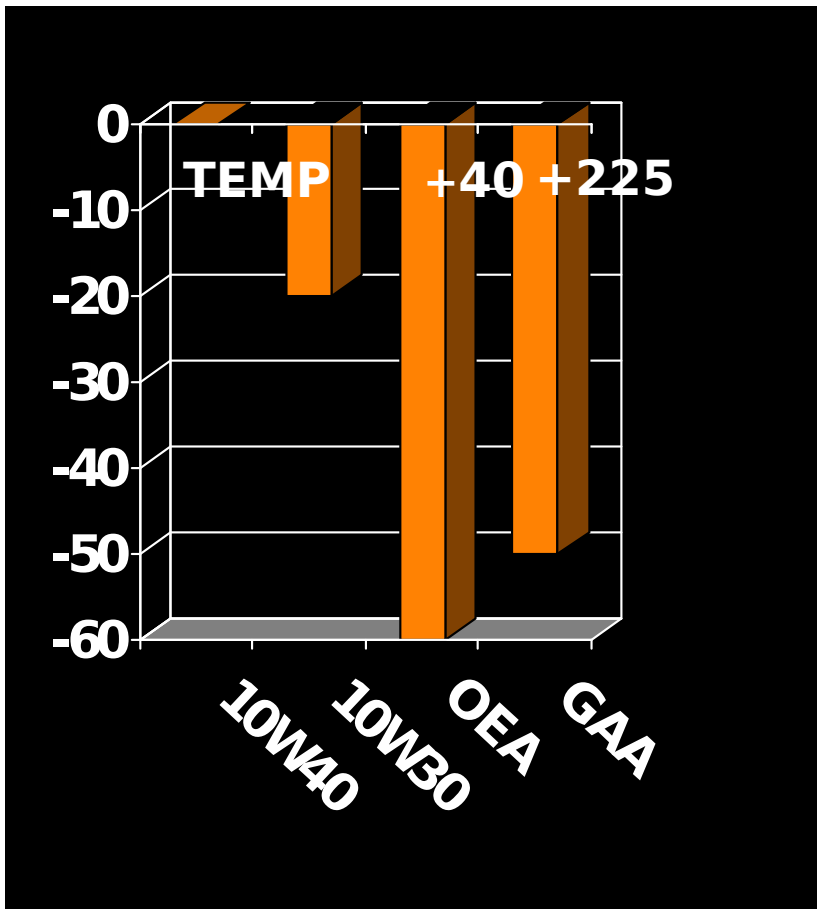
Hydraulic Fluids

Hydraulic fluids are specified in Appendix H of the Cold Weather Operations Handbook

Use OHT in place of FRH for temperatures of -25° F and below

Lubricants

- *Check TM to find recommended lubricant*
- *Store lubricants in a warm place*
- *Oil Engine Arctic (OEA) can be used for short periods in temperate conditions*
- *Grease Automotive Artillery (GAA)*
- *The Lube Orders are based upon three temperature ratings – above 32 F; from 40 F to –10 F; 0 to –65 F*



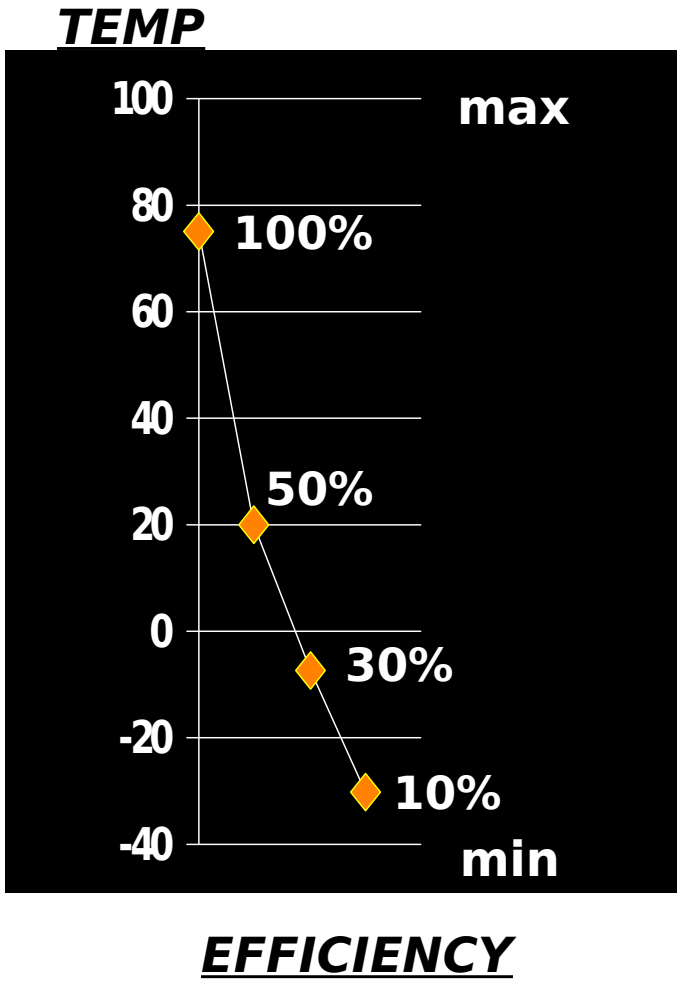
Vehicle Batteries

Batteries are adversely affected by cold; as the temperature drops the current available decreases; at -40º F the power available is near zero

A fully charged battery will not freeze; vehicle batteries do not receive an adequate charge unless warmed to 35º F

Test batteries every three days; fill with 1.280 electrolyte for protection to -90º F

Gel Cell batteries are generally maintenance free and are replacing older style storage batteries



Small Equipment Batteries

Small equipment batteries must be alkaline type and not dry cell.

Keep small equipment batteries in interior pockets to help keep them warm.

Nickel-cadmium type is very effective at low temperatures.

Lithium sulfur dioxide batteries are recommended for cold weather.

Preparation for Operation and Vehicle Winterization

Conduct PMCS using TM; see operation under other than usual conditions

Wheel Bearings

Hydraulic Braking Systems; check brake reservoirs; no special lubricant required

Air Brake Systems – ensure valves are operational and that air tanks are drained to prevent condensation from forming and freezing

CTIS and air compressors – same check as Air Brake systems

Steering Gear fluid reservoirs have correct fluid

Preparation for Operation and Vehicle Winterization (cont.)

Shock Absorbers
Springs
Tires
Fire Extinguishers winterized
Oil Engine Arctic (OEA)
Belts and Hoses
Thermostats
Winter Fronts or radiator shutters
Vehicle personnel heaters mounted and operated
Tire chains, swingfire heaters ice scrapers etc. are present

Vehicle Operation

Vehicles must be properly tuned prior to use

Heat retention devices should be installed

Allow engine to warm for at least 3 minutes prior to movement

From -20°F to -60°F, periodic starting/movement may be necessary to keep vehicles operational

Downgrade hoists and winch capacities by half

Engine idle must be as indicated in TM to maintain battery charge

Weapons: Common Problems and Solutions

Sluggishness:

- ***CLP thickens in cold conditions and freezes at -35º F***
- ***Lubricate with LAW; if none available weapon should be fired dry***
- ***Graphite lubricant is another option***

Condensation:

- ***Occurs when weapons are brought into heated shelters; condensation freezes when the weapon is taken back into the cold***
- ***Store weapons outside***

Weapons: Common Problems and Solutions (cont.)

Fouling from Snow and Ice

- ***Use muzzle covers or improvise***
- ***Use a de-icer for frozen weapons***

Visibility

- ***Ice Fog at -30º F; difficult to observe strike of rounds; gives away position***
- ***Frequent position changes may be needed or observer to spot/adjust rounds***

Breakage and Malfunctions

- ***Extreme cold increases the chance of metal and/or plastic component failures***
- ***Slow firing rates to allow the weapon to warm gradually***

Weapons: Common Problems and Solutions (cont.)

Emplacement Issues

- *Deep snow and frozen ground present problems*
- *Various techniques discussed for specific weapons systems*

Reduced Velocity and Range of Projectiles

- *As temperature drops so does muzzle velocity and thus the range of projectiles*
- *Internal Ballistics*
- *External Ballistics*
- *Re-zero weapons in extreme cold conditions*

Rifles and Automatic Weapons

- ***Re-zeroing required for all weapons systems***
- ***High rate of breakage; require test firing prior to deployment.***
- ***Units must carry extra parts***
- ***Short recoil and buffer freezing causes malfunctions***
- ***Begin with slow rate of fire***

MK-19

Use GMD at temperatures below -25º F

Use cloth covers rather than plastics to protect the weapon from the elements

Mortars

Temperature below 10°F, lube with LAW, (9150-00-292-9689) instead of CLP, (9150-00-231-2361)

Wipe inside of bore dry before going out into the cold

Cover cartridges

Keep fire control instruments in their cases

Cushion base plate

Use anticontact gloves for dropped rounds

Missile Systems

The TOW, Javelin and Dragon can be used down to -25 F and can be stored down to -65

Double the back-blast area of all missile systems

The Javelin will drop when fired in the extreme cold; the weapon should not be fired from defilade or reverse slope positions

Grenades and Demolitions

Smoke grenades should be deployed on a platform, hard ground or wired to a stake

Grenades may stick to gloves/mittens if either item is wet

C-4, detonation cord and time fuse may need to be re-warmed prior to use

Double hangfire and misfire waiting times

Communications- Signal Strength

Aurora Borealis activity can adversely effect or absorb HF signals

FM signals are not degraded; on occasion their range will be increased.

Communications- R/T's

- ***Breath shields must be used on microphones***
- ***Batteries must be kept as warm as possible***
- ***Allow radios to warm for 3 to 4 minutes prior to operation***
- ***Place radios and switchboards off the ground and away from tent walls***
- ***Radios exposed to extreme cold are sensitive to rough handling***
- ***Keep radios away from high heat sources such as the SHA or H-45***

Communications Wire

Spare connectors, cables, and handsets should be available

TA-1/PT performs poorly in extreme cold beyond squad or platoon boundaries; TA-312/PT is reliable when powered by alkaline BA-3030/U

Wire communication line should not be laid on the ground along ski trails

Wire may freeze, becoming difficult to recover

Communications - Antennas

- Any icing will detune and reduce range for directional antennas; this effect increases as frequency increases
- Difficult to erect antenna masts; use pitons or steel tent pegs; lashing a tree is effective
- RG-213 Coax is recommended; RG-8 which cracks at -20
- Use of a counterpoise may be required

Communications- Antennas (cont.)

"Precipitation static"- flakes or pellets of highly charged snow

Static shocks can result from leads of ungrounded antennas

Orientation of antennas must take magnetic declination into account

Communications-Grounding

- Frozen ground offers high electrical resistance; permafrost obstructs ground rods
- Do not use ground or counterpoise for more than one transmitter or electrical system
- Ground rod must be driven deeply into ground or through ice to water; tree spike method is also effective
- Use Surface Wire Ground System (SWGS)

Generators

High failure rate often due to outdated Lubricant Orders

Use clean fuel- contaminated fuel causes generator fuel line icing

Check, drain, and clean filters daily and at shutdown

Preheat and provide a small shelter so that the generator provides its own heat

Proper grounding

Summary